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Inclusive Development and Climate Change: The Geopolitics of Fossil Fuel Risks in Developing Countries

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Abstract: This conceptual paper brings together two previously disparate strands of scholarship on climate change and development together with emerging studies of stranded assets. It addresses the question: What are the lessons learnt from this literature for the way developing countries should 'develop' in a post-Paris Agreement world? The paper argues that instead of a blind neo-colonial process of rapidly replicating the development paths of already industrialized countries – especially in the context of the fossil fuel sector – developing countries must adopt their own unique development strategies that are more inclusive and transformative. The foregone economic gains from not investing in fossil fuels maybe compensated by the reduced risks of stranded assets and climate change impacts in the future – as well as the reduced risks of climate change impacts on, for example, the agricultural sector – which may facilitate their own unique paths toward inclusive development.

Key words: stranded assets, inclusive development, wellbeing, climate change, Paris Agreement

1. Introduction

Since World War II, international development scholars and national policymakers have debated about the question of what is development and how to develop (Meier & Stiglitz 2001; Thorbecke 2006; Easterly 2007; Gupta & Thompson 2006). Since the 1980s, the debate was broadened to include environmental issues, which was subsequently reframed as sustainable development (World Commission on Environment and Development 1987). Since the 2000s, scholars increasingly discussed how human civilization is now entering the Anthropocene, and that the need to address ecological issues has become more urgent (Steffen et al. 2011; Crutzen 2006; Lewis & Maslin 2015). In this context, in 2015, the member states of the United Nations adopted the Paris Agreement on Climate Change (Paris Agreement 2015), where they committed to ensure that global average temperature would not rise beyond 1.5-2 degrees Celsius in relation to pre-industrial levels. This Agreement entered into force on 4 November 2016 and applies to the period beyond 2020. Countries have also promised to commit to reducing their (rate of) growth of greenhouse gas (GHG) emissions and – implicitly – to eventually phase out all emissions (Gupta 2016). At the same time, growing global inequality led to

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the adoption of the Millennium Development Goals in 2000, and in 2015, the same member states adopted 17 Sustainable Development Goals (SDGs) that aim to tackle socio-ecological challenges, including climate change, by 2030.

The above political commitments have taken place against two theoretical traditions: one in relation to development and climate change in which different disciplines have addressed their various challenges within the context of developing and industrialized countries. A second strand, within a more narrow scholarship, examines obsolete technologies, stranded assets, and stranded resources within the field of technology, health, and economy, expanding in recent years to include stranded resources. These theories approach the question of development from different angles – the first more positively looking at what needs to be done and emphasizes opportunities; the second more negatively learning from economic and other losses resulting from development processes and choices and, simultaneously, emphasizes risks.

Before moving ahead, we would like to note that the term 'developing countries' refers broadly to the 150 countries of the Global South. These countries are not homogenous; however, most of them have a shared history of colonization, have a relatively low or lower income per capita than in industrialized countries, and are mostly outside the club of the OECD countries. Having said that, some of these countries are rapidly developing countries – also referred to as emerging economies – such as China, while some are middle income countries and some are less developed countries. In this paper, we focus on the middle income countries and emerging economies.

Since some countries have become rich from their fossil fuel resources (e.g. Norway and OPEC countries) and others link dependence on fossil fuels with energy insecurity at the national level, developing countries are adopting different strategies to gain access to fossil fuels (Amineh & Yang 2012). At the same time, scholars warn that obsolete technologies leave countries and industries with stranded resources and assets (Uibeleisen 2011). Against this background, this conceptual paper addresses the question: What are the lessons learnt for the way developing countries should 'develop' in a post-Paris Agreement world, especially in relation to current and future fossil fuel investments within the context of their larger development trajectory? In doing so, we combine the theories of development (see 2) and stranded assets (see 3) through an inclusive development lens (see 2.3 and 4), before drawing some conclusions (see 5).

To illustrate these dynamics, we assess the experiences of three countries – the rapidly emerging economy of China, the middle income country of Nigeria, and the least developed country of Kenya, who recently graduated to the status of a middle income country and will have to work hard to keep that status. Each of these countries represent different stages of development and also face different fossil fuel dilemmas. For China, it is how to enhance the country's development while staying within its legally binding commitments made under the Paris Agreement. This is further complicated as China has embarked on a global oil and gas purchase and investment spree (Amineh & Yang 2012) and is heavily investing in coal fields at home, while also being a global leader in wind and solar energy (Gupta & Wong 2014). For Nigeria, oil has been key to its foreign exchange revenues and its national income for decades, but has not substantively enhanced the wellbeing of its people or increased their access to energy, while local to global pollution has increased and has been condemned by courts (Nwajiaku-Dahou 2012; Ite

2007). For Kenya, newly discovered oil and gas reserves has raised hopes in the country about its prospective wealth; the question is whether it is wise to invest in it (Bos & Gupta 2016). Clearly, these three countries will also be exposed to the impacts of climate change, and will likely experience impacts on rain dependent agricultural communities and in low-lying coastal communities. These three examples showcase the risks and trade-offs of pursuing fossil fuel-driven development pathways, and point to lessons for more inclusive and transformative development patterns in a post-Paris Agreement world.

2. Development, inclusive development, and developing countries: Opportunities

2.1 Introduction

This section first discusses the theories of development, then introduces inclusive development, and elaborates further on what such a theory would imply for the case study countries.

2.2 Theories of development

Many development scholars and practitioners believe that development is a linear path and that developing countries must 'catch up' with the industrialized world. Seventy years of development and development cooperation literature shows how practically in every decade, new prescriptions on what is development and how industrialized countries should help developing countries develop have been proposed and implemented (Meier & Stiglitz 2001; Thorbecke 2006; Easterly 2007; Gupta & Thompson 2006). Most of these have aimed at making developing countries follow in the footsteps of the industrialized world, though there have also been discussions about how developing countries should 'leap frog ahead' and skip some stages of development. This is in line with the neo-colonial view of development where developed countries also market specific technologies and capacities to developing countries as a way to build capacity and 'develop' in the image of the North and using Northern discourses (such as through the rhetoric of governance, good governance, and neo-liberal capitalism) (So 1990).

From the developing countries' perspective, many have felt that while aid provided some assistance, subsequent trade, investment, and environmental rules have actually been developed to prevent their development (Mickelson et al. 2008). This has led them to argue in favor of the New International Economic Order and the Right to Development since the 1960s (Schrijver & Weiss 2004). The Right to Development was adopted by the United Nations General Assembly in 1986, and argues that developing countries have the right to develop and that this allows them some leeway in their behavior at the international level (Amador 1990; Chowdhury et al. 1992). Barely six years later, this idea was reformulated as the Right to, and duty for, promoting Sustainable Development in the Climate Change Convention of 1992, which codified the content of the Right to Development into a legally binding Convention (Gupta and Arts 2018).

However, developing countries feel that they need to first pollute the environment ('development first') before they are rich enough to afford to maintain the ecosystem services of nature. This tends to follow from an inappropriate understanding of the 'inverted U-shaped' environmental Kuznets curve (Malenbaum 1978; Jänicke et al. 1989; Grossman 1995; Selden & Song 1994) – that patterns that were valid for the developed countries in the past are necessarily predictive of the behaviors of developing countries in the future. In a world without global tipping points, countries could discuss their individual futures without taking into account how national trends cumulatively and collectively lead to crossing planetary boundaries (Rockström et al. 2009). But in the context of the Anthropocene, this is not a luxury for either developing countries or industrialized countries (Crutzen 2006).

At the same time, the emphasis on marketing neoliberal capitalist approaches globally has led to trade-offs in favor of narrowly defined economic growth in financial terms, rather than actually implementing hard sustainable development that allows no trade-offs between social, ecological, and economic priorities (Parris & Kates 2003; United Nations 2016). This has led both developed and developing countries to focus on 'growth' first – one can see this in the case of the US's refusal to agree to legally binding emissions targets for the period between 1992 and 2020 as well as the reluctance of Russia, Canada, New Zealand, and Japan to commit to targets in the 2012-2020 period (Gupta 2016). Meanwhile China has adopted the philosophy of the green and circular economy as a way to emphasize growth and the environment as its strategy for the future (Zhang 2010; Jiang et al. 2010), the question is whether this will end up being greenwash.

2.3 Inclusive development

This history can be contrasted with the Inclusive Development view which suggests that both developing and industrialized countries must find unique, country specific, alternative development strategies towards sustainable development (Pieterse 1998; Friedmann 1992). Under this view, enhancing development requires not only directly meeting both individual and collective social wellbeing, but also investing in the maintenance of the ecosystem services of nature on which human wellbeing depends (Millennium Ecosystem Assessment 2003). If such services are by definition finite, this means that any technological approach adopted to achieve development must increasingly stay within ecosystem limits, or else it will come at the cost of development for others. Inclusive development questions the continuous linear quest for growth as reflected in increasing income for all (Gupta et al. 2015). Continuous growth is only possible by competitively turning all natural resources and ecosystem services into commodities and technologies with a price, or through a system in which capital begets capital. Instead, inclusive development focuses on enhancing human wellbeing and living within ecosystem services, thus creating a sustainable society rather than economy.

Figure 1 Inclusive development (ID) variants (ID-1 and ID-2)

Insert Figure 1 here

Figure 1 captures this debate. The first triangle represents sustainable development with its three corners showing social, economic, and ecological aspects. The grey triangles within it focus on the socio-ecological aspects that are key to inclusive development. The first triangle represents the world of the Kyoto Protocol, where countries are unwilling to commit to reducing emissions if it compromises their economic growth and competitiveness. Here, the concept of inclusive development (ID-1) also gets trapped in current dominant thinking about development and where the economy is more dominant in the green *economy* concept. The second triangle represents a shift towards a society in which development is seen more as enhancing socio-ecological wellbeing and where ecosystem limits dominate in the *green* economy. This ensures, for example, that ecosystem services are available for agricultural and rural sectors. One can argue that the Paris Agreement and the Sustainable Development Goals tries to emphasize individual and collective social wellbeing over national GNP or GNP per capita: economic growth is mentioned only a handful of times in the entire SDG document (Gupta and Vegelin 2016).

In the next sections, we apply an understanding of inclusive development in the context of climate change to the case studies of China, Nigeria, and Kenya.

2.4 The Case of China

China's economy has only started to grow in recent decades. In the 1990s, China's income was relatively low. But in 2014, the country's population grew to more than 1.3 billion and its GNI was nearly USD 18 trillion. Even though China has high emissions today, its cumulative share between 1850 and 2002 was only about 7.6% compared to 29.3% of the US. Recent emissions have been higher, but any equitable sharing of emission responsibilities reduces the need for China to do as much as the US (Baer et al. 2008; Opschoor 2010; Dellink et al. 2009). However, the sheer size of its emissions requires China to address emissions growth and achieve peak emissions soon, or else global emission reduction goals cannot be achieved as China is locked into a fossil fuel-dependent development trajectory.

Over the past 25 years, China has called on industrialized countries to reduce their GHG emissions, and has argued that policy change in developing countries must be dependent on international technological and financial assistance from industrialized countries under Article 4.7 of the Climate Change Convention. Furthermore, China has asserted its right to (sustainable) development by encouraging the adoption of measures with co-benefits, such as energy conservation and efficiency (Stensdal 2012; Lewis 2007; Richerzhagen & Scholz 2008; Gupta & Wong 2014). This overarching climate change policy emerged as China transitioned from a centrally planned economy to a socialist market economy

Though China's energy policy is centrally overseen by the State Economic and Trade Commission, specific actions are executed by different state enterprises. In addition to investing in fossil fuels at home and abroad, China also prioritizes renewable energy (Jiang et al. 2010) and has committed to a global 1.5-2°C goal by signing the Paris Agreement in April 2016. In its Intended Nationally Determined Contributions (INDC), China aims to reduce its GHG emissions per unit of GDP by 60-65% by 2030 compared

to 2005 levels, and will do so by investing in the demand side of energy through promoting 'low-carbon lives' and 'low-carbon days' (Gupta 2014).

Despite this, China continues to invest heavily in oil exploration abroad on account of its limited domestic sources, and is now the world's second largest oil consumer and the largest oil importer. For example, China has invested in oil and gas fields in Saudi Arabia (Mo 2014) and in Ghana since 2010 with an intent to oil importation. Still, recent studies have shown that Chinese oil companies in Ghana often act independently of Chinese state interests and do not contribute to the policy needs of Ghana. In another example, China has pursued joint ventures in Sudan that have led to both profits and social investments in the country. These investments face both local political risks – as exemplified by South Sudan gaining independence in 2012 – as well as global political risks (Mo 2014).

When theorized in relation to the right to development and energy security, China and its oil companies have a right to access fossil fuel resources for profit. However, since much of this revenue is only channelled back to China for short-term development purposes, the country is not actually improving its energy security needs. In this case, new purchases and investments in countries such as Ghana and Sudan may eventually result in stranded assets and a reduction in long-term returns on investment, as well as simultaneously exposing the country to climate change risks and impacts. Finally, continued investments in fossil fuels may further expose Chinese agriculture and other critical sectors to the impacts of climate change.

2.5 The Case of Nigeria

Since discovering oil in commercial quantities in 1956, Nigeria has become an oil-producing nation and joined the Organization of Petroleum Exporting Countries (OPEC) in 1971. Currently Nigeria has an estimated 37 billion barrels of proven crude oil reserves, which is the second largest in Africa after Libya. The country also has an estimated 180 trillion cubic feet of proven natural gas reserves, making it the largest in Africa and the ninth largest in the world. Despite this vast resource wealth, oil profits only contribute to 14% of Nigeria's GDP, even though it accounts for 75% of government revenues (from taxes on and royalties paid by oil companies) and 95% of export revenues.

Nigeria has long been touted as a poster child of the 'resource curse', which notes that nations with vast natural resource wealth actually perform more poorly in economic terms when compared to countries with resource deficits (Sachs & Warner 2001). In this case, revenues from extracting natural resources displace other export-led drivers of economic growth, including trading and manufacturing functions, while also taking away investment opportunities in critical social sectors such as education, entrepreneurship, or innovation (Sachs & Warner 2001). For example, the contribution of oil revenues as a proportion of total government revenue in Nigeria rose from 26.3% in 1970 to 82.1% in 1974 (Frynas 2001), and this number has continued to increase.

Others note that revenues from natural resource extraction are also easily appropriated, which means that countries can easily fall prey to corruption and a failure to target pro-

growth policies, resulting in unequal wealth distribution and the creation of 'predator states'. For Nigeria, the high proportion of government revenues attributed to oil and gas also negates the need to levy high taxes, thus reducing the demand for public sector accountability (Corrigan 2014), again leading to corruption, poor governance, and conflict (Ite 2007). In particular, according to the Society of Petroleum Engineers (SPE), an estimated USD 9.1 billion per year is lost to oil thieves, while there are also accounts of large sums of money being transferred abroad (Nwajiaku-Dahou 2012).

Nigeria has historically only contributed minimally to global GHG emissions. In per capita terms, the country's emissions in 2011 were 0.5 metric tons compared to 6.7 metric tons per capita in China. As with other developing countries, Nigeria is vulnerable to climate change risks and impacts, as experienced by the high rates of desertification in the North and increasing flooding, sea level rise, and storm surges in the Niger Delta region (Odjugo 2010). Nigeria is also projected to encounter a loss in GDP of between 6% and 30% by 2050 on account of climate change (Odjugo 2010). In response, Nigeria's national climate change policy focuses on building institutional capacity, participating in global initiatives, investing in science and technology, promoting research, increasing public awareness, and mobilizing communities for climate change adaptation measures.

Prior to the Paris Agreement, the Nigerian government announced its Intended Nationally Determined Contributions (INDC), which sought to peak national carbon emissions by 2030, reducing overall carbon intensity by 50% of 2005 levels, and realizing 30% energy efficiency. In practice, however, Nigeria continues to experience a lack of domestic energy security, which prevents the country from pursuing a low carbon future or proactively adapting to projected climate change impacts. Despite the political rhetoric on economic diversification over the past thirty years, Nigeria has yet to implement many of these policy directives.

2.6 The Case of Kenya

Despite Kenya's recent move from least developed country status to a middle income country, the country continues to experience high income inequality – with a Gini coefficient of 47.68 (UNDP 2014) – and a high proportion of the population (43%) living below poverty line (below USD 1.25 per day) (UNDP 2014). Kenya is extremely vulnerable to climate change impacts, especially droughts and floods that lead to food insecurity (Government of Kenya 2007; 2008). Furthermore, Kenya's economy is highly dependent on climate sensitive sectors such as tourism, agriculture, and forestry (Government of Kenya 2007; 2008).

Significant oil reserves were discovered around the South Lokichar Basin in the northwest of Kenya in 2012. Although oil production has yet to commence (as of 2015), the Kenyan government is already actively pursuing policies to manage it. Most in Kenya celebrate the discovery of oil, and argue that the resource will be a driver of prosperity while also supplying necessary capital for industrial and infrastructural development (Patey 2014). New sources of oil will also help alleviate existing energy supply constraints and empower communities in the region by providing employment, trade, and commercial opportunities. Furthermore, the government argues that new sources of resource wealth will improve the country's overall energy security and help transform the country into a newly industrializing middle-income country with a high quality life for

all (Government of Kenya 2007).To achieve these development objectives, Kenya's *National Climate Change Action Plan* and the *National Climate Change Response Strategy* both call for the adoption of a 'low carbon climate resilient development pathway' (Government of Kenya 2010; 2013).

Kenya's current solar, wind, and geothermal energy potential remains largely untapped due to inadequate domestic expertise and lack of investment funding (Awuor & Ouya 2014; Government of Kenya 2013). At the same time, the issue of stranded resources and assets is not perceived as a real risk (cf. Nigeria) as policymakers argue that Kenya should be entitled to use newfound oil resources for development purposes.

Historically, Kenya has contributed approximately only 0.1% of the total global emissions, which are largely attributed to land use change and forestry. Despite its negligible responsibility for causing climate change, Kenya's Intended Nationally Determined Contribution (INDC) pledges to cut the country's GHG emissions by 30% by 2030. However, since over USD 40 billion is needed to realize Kenya's mitigation and adaptation contribution, the implementation of many of these targets relies on international capital, technology, and capacity support (Government of Kenya 2013).

Whether prospective oil resources will foster equitable and sustainable development in Kenya remains questionable. Notable governance constraints include a general lack of public sector transparency and accountability, ineffective participation and consultation processes, and low institutional capacity to safeguard the environment. Furthermore, Kenya could face the resource curse as the newly established oil industry may capture the economy, leading to the displacement of other modes of economic development (such as tourism, horticulture, coffee, and tea production). Without an adequate revenue management vision, corrupt behaviors that permeate throughout other sectors may spill over into the oil sector (cf. Bos & Gupta 2016).

2.7 Inferences

The above sections argued that understanding the context of the development challenge is key to evaluating the opportunities in development, especially in terms of sustaining our biodiversity and ecosystem services to such an extent that we can actually continue to enjoy and share our wellbeing. All three countries hope to adopt a more-or-less linear growth path to ensure more material wealth, but this is in conflict with the Paris Agreement. Though the Paris Agreement only applies to China as Kenya and Nigeria have yet to ratify it (as of October 2016), it is only a question of time before they will. Under the circumstances, Kenya and Nigeria must avoid long term lock-in of oil and gas production, as well as prevent an economy and infrastructure that is dependent on oil and gas or dependent in financial terms as illustrated by the resource curse argument. So it is in the interest of developing countries to avoid runaway climate change as they will likely face long-term negative economic, social, and ecological consequences. Furthermore, under the SDGs, it is also vital that these countries maintain their 'free' ecosystem services as society at-large is dependent on these services for livelihood and economic wellbeing. Figure 2 illustrates the potential different routes to sustainable and inclusive development for China, Nigeria, and Kenya.

Figure 2. Unique routes to sustainable development

Insert figure 2 here

3. Stranded resources and assets and the developing countries: Risks

3.1 Introduction

As developing countries are likely to be legally bound by the Paris Agreement in the near future, there are a number of reasons why they should refrain from investing in fossil fuels. This section looks at the possible risks of a business-as-usual development trajectory by building on the literature on stranded resources and assets. Then it discusses possible geo-ecological risks and how these may play out for our case study countries.

3.2 Stranded resources and assets, obsolete technologies

The literature on stranded resources and assets focuses primarily on financial (e.g. contracts) or physical (e.g. infrastructure) stranded assets that may lose their economic value because they become obsolete before the end of their expected life (Crew & Kleindorfer 1999). This generally happens because of changes in innovation (Caldecott & McDaniels 2014), social values/conditions (Robins 2014), environmental problems (Ansar et al. 2013), or war/political sanctions which lead directly to changes in consumer preferences in the market or indirectly as a consequence of changes in the legislative or policy environment (Generation Foundation 2013; Robins 2014; Ansar et al. 2013; Caldecott & McDaniels 2014). At the national level, this occurs in regulated sectors such as the electricity supply sector, including natural gas and nuclear plants. Thus, for example, a fossil fuel thermal plant that has to be closed down for environmental reasons is a stranded asset. At the international level, this could be because of currency devaluations, political sanctions, trade restrictions, or international treaties (Crew & Kleindorfer 1999). Chinese oil investment contracts in Iraq could not be followed through because of political sanctions are also an example of a stranded asset. This means that apart from the physical infrastructure that becomes a 'white elephant', the costs invested in the physical infrastructure can also no longer be recovered as the 'book value' is in excess of the 'market value'.

The literature does not define stranded resources. Such resources are key challenges for developing countries that are late to development and have not yet used all the resources within their countries so far. One could define a stranded resource as one that cannot be extracted and used because of geographical reasons (too far from market, too deep, etc.), infrastructural reasons (too difficult to transfer), or economic reasons (too expensive to mine or commercial non-viability) because such use may lead to major shocks to biodiversity and the ecosystem (Roberts 2008; Khalilpour & Karimi 2011), and this leads to either changes in consumer behavior or changes in policy or law, which further leads to the resource not being used. For example, forests in developing countries are increasingly being protected – this means that these countries are being encouraged not to deforest their lands. As a consequence, these countries forego certain development options, such as using = forestlands for biofuel production or for expanding cities. Furthermore, developing countries have faced geographical, capital, infrastructural, and technological limits that have constrained their use of certain resources such as natural gas (Khalilpour & Karimi 2011) and even renewables (Leighty & Holbrook 2012).

In general, a resource is converted into an asset that is then expected to contribute to national growth. In the era of neoliberal capitalism, as Figure 3 illustrates, there are no perceived limits to resources, assets, and growth. But in the era of the Anthropocene, this can lead to major damages to the ecosystems that provide these very resources (Crutzen 2006), which can then affect our assets and the growth rate. This may also lead to stranded assets that will reduce growth as well as stranded resources that may be perceived as potentially reducing growth. We argue in Figure 3 that the modes of continuously converting all resources into assets are unsustainable approaches.

Figure 3 An unsustainable model of converting resources into assets

Insert figure 3 here

3.3 Potential geo-ecological risks

Although developing countries may argue that stranding a resource may lead to a potential loss of economic growth (Bos & Gupta 2016), this section argues that while there are short-term opportunity costs of stranding a resources, there are also long-term significant geo-ecological risks of converting these resources into assets. As an example, we take the case of investments in the fossil fuel sector in China, Nigeria, and Kenya.

The Paris Agreement (2015) requires all countries to eventually phase out the use of fossil fuels – earlier rather than later – if they are to stay below the 1.5-2°C limit. This ambition is also embedded within the overall Sustainable Development Goals (2015), which aim to stay within broader ecosystem boundaries by 2030. This implies that fossil fuel technologies are destined to become obsolete within this century (Carbon Tracker 2013). Backcasting from the future, the question is whether it is worthwhile for developing countries to invest in this technology if they are required to phase it out before the end of its 'useful life'? This may serve the interests of those industrialized countries and companies that actually want to sell this resource and its related technologies to others, but may not actually serve the interests of developing countries.

This question becomes all the more pertinent as some developing countries, including Uganda, Ghana and Kenya, have now discovered oil resources. Others – such as Mexico, Brazil, Argentina, Morocco, Algeria, Tunisia, South Africa, China, India, and Indonesia – find that there may be opportunities for fracking in their countries. Still others find that they are suddenly able to buy up oil and gas resources in other parts of the world (e.g. China). Furthermore, some have domestic coal reserves (e.g. China) while some are importing coal from Australia (e.g. India). These countries seem to think that they have no choice but to continue to invest in fossil fuels. However, even extraction and generation processes may have many negative side effects (e.g. fracking or mining). We argue that developing countries face a series of geo-ecological risks by engaging in this process (see Table 1).

Table 1 Categories of geo-ecological risks experienced by developing countries in the context of climate change

Type	Risk	Explanation
Ecological Risks	Risks of climate change impacts	Risks of exposure to climate impacts, such as sea level rise, melting glaciers, extreme heat, water scarcity, extreme events, etc.
	Pollution impacts on local ecosystems	Implications of chemical or industrial pollution on ecosystem health and function
	Loss of ecosystem services	Destruction of valuable ecosystem functions, such as the destruction of mangroves, groundwater recharge, etc.
	Risk of phase out policy	Risks associated with the implementation of the Paris Agreement to phase out fossil fuel extraction and usage
Social Risks	Human health risks	Impacts on human health through vector-borne or non-communicable diseases.
	Livelihood and employment risks	Loss of access to social protection and welfare opportunities such as social networks, livelihoods opportunities, etc.
	Civil violence risks	Impacts of civil conflict or communal violence
Economic Risks	Loss of state financial resources	Risks of prematurely writing-off investments
	Loss of employment opportunities	Loss of access to income generation or wealth creation opportunities
	Risk of lock-in	Loss of revenue due to the inability to alter dominant energy systems
	Loss of shareholder value	Loss of income due to the carbon 'bubble' or because of loss of oil and gas demanding markets
	Risk of divestment	Risk of institutions getting rid of their existing financial investments
	Risk of not receiving aid for adaptation	Loss of access to bilateral or multilateral support for adaptation, risk reduction, or resilience-building activities

	Indirect social, ecological, and institutional costs	Loss of general investment opportunities, ecosystem services, livelihood strategies, etc.
Institutional/Legal Risks	Risks of litigation and compensation	When the public demands that the state takes action (e.g. Urgenda case in the Netherlands)
	Policy freezing and international litigation	The threat of freezing national policy in order not to be sued by foreign investors in the host country under bilateral/multilateral investment treaties
	Compensation to international companies	Risk of having to financially compensate companies who no longer are able to invest due to changes in policy or institutional context
Political Risks	Risks of nationalization of industries	Risk of other nations taking ownership over (state) companies operating abroad
	Risks of war	Impacts of trans-boundary war, civil conflict, or violence.
	Risks to sovereignty	Risk of loss of a country's ability to govern and enforce laws
	International sanctions and other geopolitical risks	Risk of sanctions, limits, and quotas imposed by the international community

3.4 Application to China, Kenya, and Nigeria

The right to development of developing countries is restricted since fossil fuel use must be eventually completely eliminated, and since this right has been reframed as the right to, and duty to, promote sustainable development. Furthermore, this right to development is only valid if oil revenues are made available to governments (i.e. there are limited tax holidays or tax evasion and avoidance is low), if governments are subsequently able and willing to diversify (i.e. promote affordable renewable sources, ensure energy access, redistribute the revenues to invest in other sectors, or avoid corruption), and if national economies are advanced according to equitable and inclusive principles.

On the contrary, the example of Nigeria highlights how oil revenues have led to both the resource curse and exclusive dependence on oil and gas revenues, which have led to an inability to meet domestic energy demands, promoted corruption, and reduced overall development prospects. This undermines Nigeria's argument for the right to development. The example of Kenya shows that despite the discovery of oil resources that can spur development, the actual financial benefits to local companies and communities may be negligible, unless the state is able to proactively control incoming multinationals and is fully aware of the consequences of engaging in agreements given international investment law. Finally, the example of China shows that some of its foreign investments

became stranded assets because of global sanctions or import restrictions in the past, which highlight how China does not actually always benefit from access to gas and oil abroad. As China's current investments appear to be more focused on capital gains for state companies, the right to development argument may not be quite as legitimate here and furthermore – as we argue below – may pose a number of risks.

In reference to Table 1, if China, Nigeria, and/or Kenya elect to develop their fossil fuel resources into fossil fuel assets, they will encounter five broad categories of risks, with ecological risks reshaping risks in all other categories. First, *ecological risks* pertain to direct climate change impacts, such as precipitation change, temperature rise, or sea level rise. For Nigeria, this includes air and water pollution attributed to extraction activities or indirect ecological harm to the economy that further reduces the availability of ecosystem services. Other ecological risks include the imminent restructuring of national economies as required by the Paris Agreement's directive on phasing out oil and gas resources.

Second, *social risks* refer to impacts on public health, employment opportunities of workers in the fossil fuel sector, and potential political resistance leading to civil society unrest and the risk of infrastructure sabotage.

Third, *economic risks* pertain to losses experienced by the national government attributed to different social costs (such as labor restructuring, health and security costs, and general social unrest), ecological impacts (such as environmental clean-up, costs of phase out, and climate change impacts), legal and institutional costs (such as litigation and compensation as a result of phasing out oil and gas extraction, or if states are legally required to compensate multinational corporations for phasing out fossil fuels). Other forms of economic risk include loss of state revenue, loss of economic growth opportunities, and loss of shareholder value and investment opportunities, all of which can be a result of production systems being locked into fossil fuel use. Finally, states also run the risk of forgoing multilateral assistance for climate adaptation, taking on the liabilities of existing assets of oil companies, and even having to pay compensation for possible adaptation costs of others.

Fourth, *institutional and legal risks* relate the emerging costs of policy freezing or international litigation, the need to compensate local actors when the state decides to phase-out, or when states have to compensate transnational corporations for restricting their businesses in the future. New investments in fossil fuels may also result in reduced access to multilateral climate adaptation funds.

Finally, *political risks* include the risk of nationalization or other forms of commercial interference by the state, the risk of investing in unstable economics (as exemplified by China's investments in Sudan), the risk of international sanctions that prevent investment or lead to the suspension of existing contracts (such as in the case of Chinese investments in Iraq), and the risk of violent conflict in geo-politically sensitive regions.

Given these different geo-ecological risks, the assumption that developing countries can continue to emit GHGs on account of their low per-capital income in the past only holds true as long as the global community – as a collective – can still emit GHGs. However, as the Paris Agreement has set a 1.5-2^{o}C target, the opportunities for developing countries to claim their right to emissions are reducing. Since China, Kenya, and Nigeria have

all adopted Intended Nationally Determined Contributions (INDC), they have in turn also committed to a fossil-fuel free future. Furthermore, unlike the short-term impacts of political trade-offs, the risks of stranded assets attributed to proactive climate change action are likely to be definitive and long-term. The bottom line here is that it may be much more expensive to phase out a stranded resource than a stranded asset. As a result, being overly confident that industrialized countries will not suddenly demand legally binding targets on climate change and will use trade restrictions or sanctions to enforce this is unwise (Gupta et al. 2017). Clearly, there is also a risk that the Paris Agreement may not be implemented as the US threatens to leave it. An analysis taking into account the political risks reveals that investing in renewables is the least risky option (Bos and Gupta 2017).

4. Towards an alternative inclusive development future

This section draws some synthetic conclusions and elaborates on further opportunities for inclusive development. We argue that Figure 3 is an unsustainable model based on the neoliberal capitalist framing of growth, and that when sustainable development – or even the green economy and ecological modernization concepts – is addressed through this frame, it will lead to trade-offs in favor of short-term economic growth. We argue that it cannot lead to trade-offs in long-term economic growth because the resource base will be damaged beyond repair or the limits to technological substitution will be reached. But of course, some countries or investors may benefit in the short-term at the expense of others. We argue instead that all countries must revisit their resource base and analyze how much can be converted into an asset in a sustainable manner, such as in the case of analyzing maximum sustainable yield of fisheries. This then informs the resource and ecosystem base that should be protected as a *glocal* public good, and as freely accessible to all in order to enhance the individual and collective well-being of humans (see Figure 4). Such a development model implies fewer risks of stranded assets and of being affected by climate change impacts into the future.

Figure 4 An Inclusive and Sustainable Approach to Resources, Public Goods and Assets

Insert figure 4 here

As illustrated in Figure 5, the main challenge for countries is deciding what sort of energy mix to aim for. Many argue that countries must have a broad energy mix in order to meet their diverse needs. However, history has shown that past energy demand has not increased exponentially as expected as new technologies have promoted more energy efficient designs. Furthermore, for truly inclusive societies, energy sources must be accessible, affordable, and environmentally sustainable. Countries that select large fossil fuel, hydro, and nuclear sources may end up either externalizing the impacts and costs on the environment or may lose revenues because these infrastructures have to be written off earlier than their intended lifetime (see quadrant 1). If this risk of stranding assets is not taken into account – and if environmental externalities are not taxed – such energy

sources become affordable for the masses only in the short term (see quadrant 3). Renewables can also end up being unaffordable even if they are relatively environmentally friendly (see quadrant 2). However, only long-term investments in a diverse portfolio of renewable sources – combined with appropriate policy measures – will address both environmental impacts as well as ensure that such energy is affordable and inclusive of all (see quadrant 4).

Figure 5. Energy mixes and inclusive development

Insert figure 5 here

5. Conclusion

This conceptual paper set out to evaluate theories of stranded resources, stranded assets, and inclusive development to inform how developing countries should 'develop' in the post-Paris Agreement world. Given that the EU, China and India have ratified this agreement, it looks very likely that the world will move rapidly towards a phase out of fossil fuels, especially if it needs to meet the 1.5-2^{o}C target.

We first argued that the old paradigm of developing countries catching up with industrialized countries is out-dated. Both developing and industrialized countries have to find their own unique pathways to a sustainable future. Mimicking the West's history with energy consumption is unlikely to lead to a (net) zero fossil fuel world. In this context, we have argued that Kenya must not emulate the experience of Nigeria since both must become net fossil fuel free in the near future. This argument is not just a theoretical one based on where societies need to be in terms of GHG emissions, but is also embedded within economic reasoning. If the Paris Agreement is premised on a fossil fuel free world by the middle or the latter half of this century as the only viable way to reduce long-term vulnerability to climate change, this also suggests that societies should not invest in technologies and infrastructures that lock them into GHG-intensive development trajectories. For Kenya, investing in new oil extraction and oil-dependent infrastructure will leave the country in a major lock-in situation. It will also expose Kenya to the risk of stranded assets in the near future, which may prove to be more costly than investing wisely now.

The same is true for China. Since Western countries and companies have already started to divest their oil investments, many Chinese companies have rushed into invest in these same companies. Though Chinese companies may end up paying the full market price today, they will lose out on possible future revenues as their ability to divest will be significantly constrained. The risks for newcomers like China and Kenya to invest in fossil fuel is considerably higher than early investors like Nigeria, where the natural process of capital asset depreciation will lead to an eventual phase-out of oil investments within the time limit set forth by the Paris Agreement.

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Declaration of Conflicting Interests
The authors declare that they have no conflict of interest.

References

Amador, F.V.G., 1990. *The Emerging International Law of Development: A new dimension of international economic law*, New York: Oceana Publications.

Amineh, M.P. & Yang, G. eds., 2012. *Secure oil and alternative energy: the geopolitics of energy paths of China and the European Union*, Leiden and Boston: Brill Publishing.

Ansar, A., Caldecott, B. & Tilbury, J., 2013. *Stranded assets and the fossil fuel divestment campaign: what does divestment mean for the valuation of fossil fuel assets*, Oxford, UK: Stranded Assets Programme, SSEE, University of Oxford.

Awuor, E. & Ouya, S.A., 2014. An Assessment of New Product Development Process: Development and Use of Wind As An Alternative Source Of Energy In Kenya. *Innovative Systems Design and Engineering*, 5(4), pp.99–110.

Baer, P. et al., 2008. Greenhouse Development Rights: towards an equitable framework for global climate policy. *Cambridge Review of International Affairs*, 21(4), pp.649–669.

Bos, K. & Gupta, J., 2016. Inclusive development, oil extraction and climate change: a multilevel analysis of Kenya. *International Journal of Sustainable Development & World Ecology*, 23(6), pp.482–492.

Bos, K. and J. Gupta (…). Climate Change, Fossil Fuel Reserves, Stranded Resources and Assets: Lessons learnt, *Third World Quarterly,* DOI 10.1080/01436597.2017.1387477;

Caldecott, B. & McDaniels, J., 2014. *Stranded generation assets: Implications for European capacity mechanisms, energy markets and climate policy*, Oxford, UK: Stranded Assets Programme, SSEE, University of Oxford.

Carbon Tracker, 2013. *Unburnable Carbon 2013: Wasted Capital and Stranded Assets*, Carbon Tracker Initiative and Grantham Research Insitute.

Chowdhury, S.R., Denters, E.M.G. & Waart, P.J.I.M. de eds., 1992. *The Right to Development in International Law*, Dordrecht: Martinus Nijhoff Publishers.

Corrigan, C.C., 2014. Breaking the resource curse: Transparency in the natural resource sector and the extractive industries transparency initiative. *Resources Policy*, 40, pp.17–30.

Crew, M.A. & Kleindorfer, P.R., 1999. Stranded Assets in Network Industries in Transition. In M. A. Crew, ed. *Regulation Under Increasing Competition*. Boston, MA: Springer US, pp. 63–78.

Crutzen, P.J., 2006. The "Anthropocene." In E. Ehlers & T. Krafft, eds. *Earth System*

Science in the Anthropocene. Berlin/Heidelberg: Springer-Verlag, pp. 13–18.

Dellink, R. et al., 2009. Sharing the burden of financing adaptation to climate change. *Global Environmental Change*, 19(4), pp.411–421.

Easterly, W., 2007. Was Development Assistance a Mistake? *The American Economic Review*, 97(2), pp.328–332.

Friedmann, J., 1992. *Empowerment: The Politics of Alternative Development*, Cambridge, UK: Blackwell.

Frynas, J.G., 2001. Corporate and state responses to anti-oil protests in the Niger Delta. *African Affairs*, 100(398), pp.27–54.

Generation Foundation, 2013. *Stranded Carbon Assets: Why and How Carbon Risks Should Be Incorporated in Investment Analysis*, London and New York: Generation Foundation.

Government of Kenya, 2008. *First Medium Term Plan (2008-2012): Kenya Vision 2030*, Nairobi, Kenya: Government of Kenya.

Government of Kenya, 2007. *Kenya Vision 2030: A Globally Comparative and Prosperous Kenya*, Nairobi, Kenya: Government of Kenya.

Government of Kenya, 2013. *National Climate Change Action Plan 2013-2017*, Nairobi, Kenya: Ministry of Environment and Mineral Resources, Government of Kenya.

Government of Kenya, 2010. *National Climate Change Response Strategy*, Nairobi, Kenya: Ministry of Environment and Mineral Resources, Government of Kenya.

Grossman, G.M., 1995. Pollution and growth: what do we know? In I. Goldin & L. A. Winters, eds. *The economics of sustainable development*. Cambridge: Cambridge University Press, pp. 19–42.

Gupta, J. et al., 2017. The Geo-Ecological Risks of Oil Investments by China and the Global South: The Right to Development Revisited. In M. P. Amineh & G. Yang, eds. *The Transnationalization of China's Oil Industry*. Leiden and Boston: Brill Publishing.

Gupta, J., 2014. *The History of Global Climate Governance*, Cambridge: Cambridge University Press.

Gupta, J., 2016. The Paris Climate Change Agreement: China and India. *Climate Law*, 6(1–2), pp.171–181.

Gupta, J. & Arts, K., 2018. Achieving the 1.5°C Objective: Just Implementation Through a Right to (Sustainable) Development, *INEA*, https://doi.org/10.1007/s10784-017-9376-7.

Gupta, J., Pouw, N.R.M. & Ros-Tonen, M.A.F., 2015. Towards an Elaborated Theory of Inclusive Development. *European Journal of Development Research*, 27(4), pp.541–559.

Gupta, J. & Thompson, M., 2006. Development and development cooperation theory. In J. Gupta & N. van der Grijp, eds. *Mainstreaming climate change in development cooperation: Theory, practice and implications for the European*

Union. Cambridge and New York: Cambridge University Press, pp. 33–66.

Gupta, J. & Wong, K.Y., 2014. China's Evolving Development Dilemma in the Context of the North-South Climate Governance Debate. *Perspectives on Global Development and Technology*, 13(5–6), pp.699–727.

Ite, U.E., 2007. Partnering with the state for sustainable development: Shell's experience in the Niger Delta, Nigeria. *Sustainable Development*, 15(4), pp.216–228. A

Jänicke, M. et al., 1989. Economic structure and environmental impacts: East-west comparisons. *The Environmentalist*, 9(3), pp.171–183.

Jiang, B., Sun, Z. & Liu, M., 2010. China's energy development strategy under the low-carbon economy. *Energy*, 35(11), pp.4257–4264.

Khalilpour, R. & Karimi, I.A., 2011. Investment portfolios under uncertainty for utilizing natural gas resources. *Computers & Chemical Engineering*, 35(9), pp.1827–1837.

Leighty, W.C. & Holbrook, J.H., 2012. Alternatives to Electricity for Transmission, Firming Storage, and Supply Integration for Diverse, Stranded, Renewable Energy Resources: Gaseous Hydrogen and Anhydrous Ammonia Fuels via Underground Pipelines. *Energy Procedia*, 29, pp.332–346.

Lewis, J.I., 2007. China's Strategic Priorities in International Climate Change Negotiations. *The Washington Quarterly*, 31(1), pp.155–174.

Lewis, S.L. & Maslin, M.A., 2015. Defining the Anthropocene. *Nature*, 519(7542), pp.171–180.

Malenbaum, W., 1978. *World demand for raw materials in 1985 and 2000*, New York: McGraw-Hill E/Mj Mining Informational Services.

Meier, G.M. & Stiglitz, J.E. eds., 2001. *Frontiers of Development Economics: The Future in Perspective*, Washington, DC and Oxford: The World Bank and Oxford University Press.

Mickelson, K., Odumosu, I. & Parmar, P., 2008. Situating Third World Approaches to International Law (TWAIL): Inspirations, Challenges and Possibilities. *International Community Law Review*, 10(4), pp.351–353.

Millennium Ecosystem Assessment, 2003. *Ecosystems and human well-being*, Washington, DC: Island Press.

Mo, C., 2014. The Transnationalization Strategy of Chinese Oil Companies: Case Studies of Sudan and Saudi Arabia. *Perspectives on Global Development and Technology*, 13(5–6), pp.613–625.

Nwajiaku-Dahou, K., 2012. The political economy of oil and "rebellion" in Nigeria's Niger Delta. *Review of African Political Economy*, 39(132), pp.295–313.

Odjugo, P.A.-A.O., 2010. General overview of climate change impacts in Nigeria. *Journal of Human Ecology*, 29(1), pp.47–55.

Opschoor, H., 2010. Sustainable Development and a Dwindling Carbon Space. *Environmental and Resource Economics*, 45(1), pp.3–23.

Paris Agreement, 2015. *The Paris Agreement under the United Nations Framework*

Convention on Climate Change (UNFCCC), United Nations.

Parris, T.M. & Kates, R.W., 2003. Characterizing and Measuring Sustainable Development. *Annual Review of Environment and Resources*, 28(1), pp.559–586.

Patey, L., 2014. *Kenya – An African oil upstart in transition*, Oxford, UK: Oxford Institute for Energy Studies.

Pieterse, J.N., 1998. My Paradigm or Yours? Alternative Development, Post-Development, Reflexive Development. *Development and Change*, 29(2), pp.343–373.

Richerzhagen, C. & Scholz, I., 2008. China's Capacities for Mitigating Climate Change. *World Development*, 36(2), pp.308–324.

Roberts, S., 2008. Effects of climate change on the built environment. *Energy Policy*, 36(12), pp.4552–4557.

Robins, N., 2014. *Integrating Environmental Risks into Asset Valuations: The potential for stranded assets and the implications for long-term investors*, International Institute for Sustainable Development.

Rockström, J. et al., 2009. A safe operating space for humanity. *Nature*, 461(7263), pp.472–475.

Sachs, J.D. & Warner, A.M., 2001. The curse of natural resources. *European Economic Review*, 45(4–6), pp.827–838.

Schrijver, N.J. & Weiss, F. eds., 2004. *International Law And Sustainable Development: Principles And Practice*, Leiden, Netherlands: Brill Publishing.

Selden, T.M. & Song, D., 1994. Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions? *Journal of Environmental Economics and Management*, 27(2), pp.147–162.

So, A., 1990. *Social Change and Development: Modernization, Dependency, and World-Systems Theory*, New York and London: Sage Publications.

Steffen, W. et al., 2011. The Anthropocene: From Global Change to Planetary Stewardship. *AMBIO*, 40(7), pp.739–761.

Stensdal, I., 2012. *China's Climate-Change Policy 1988-2011: From Zero to Hero?*, Fridtjof Nansen Institute.

Thorbecke, E., 2006. *The Evolution of the Development Doctrine, 1950–2005*, Helsinki: Springer.

Uibeleisen, M., 2011. CCS-Technology: Implications for New Power Plants under German and European Law. *Carbon & Climate Law Review*, 5, p.264.

UNDP, 2014. *Human Development Report: Kenya*, New York: United Nations Development Programme.

United Nations, 2016. *Global Sustainable Development Report*, New York: UN Department of Economic and Social Affairs.

World Commission on Environment and Development, 1987. *Our Common Future*, Oxford and New York: Oxford University Press.

Zhang, Z., 2010. China in the transition to a low-carbon economy. *Energy Policy*, 38(11), pp.6638–6653.

Figure 1. Inclusive development (ID) variants (ID-1 and ID-2)

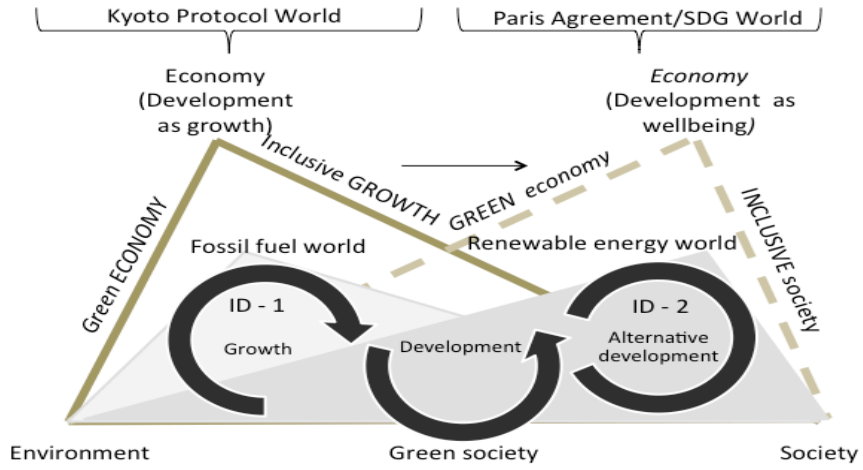

Figure 2. Unique routes to sustainable development

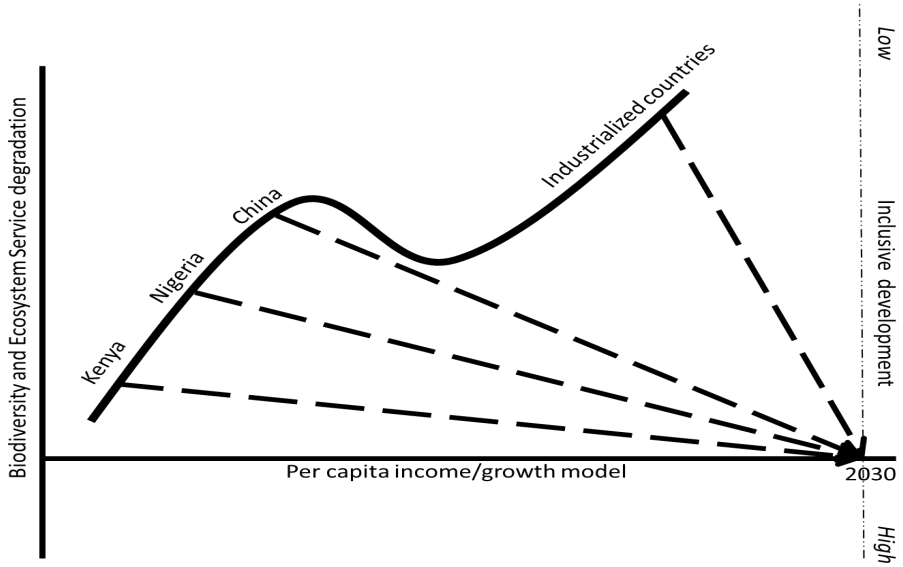

Figure 3. An unsustainable model of converting resources into assets

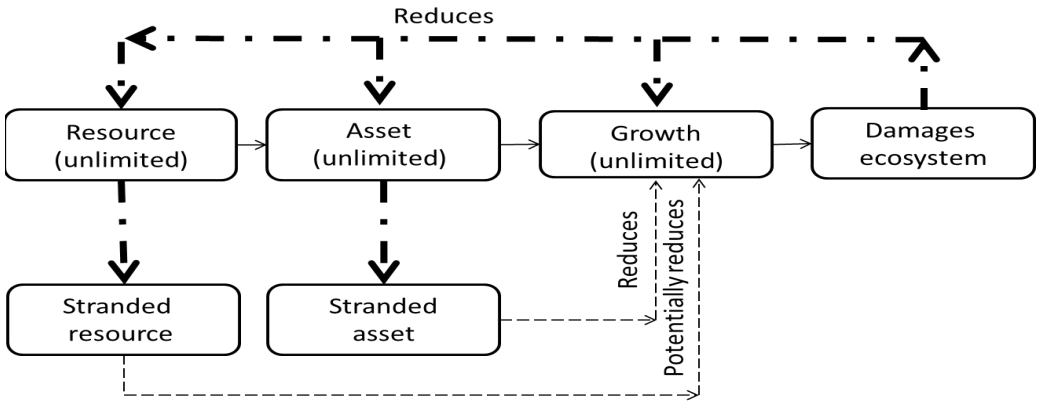

Figure 4. An Inclusive and Sustainable Approach to Resources, Public Goods and Assets

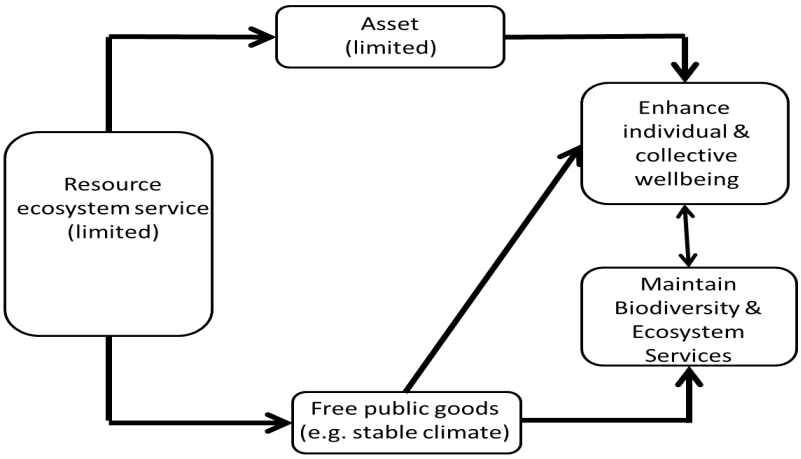

Figure 5. Energy mixes and inclusive development